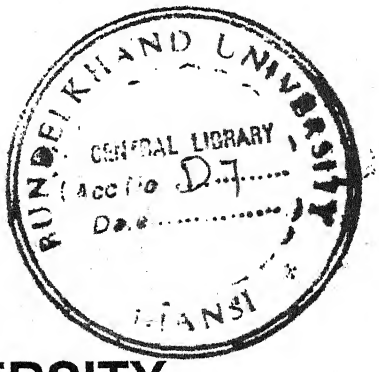
"Comparative Study of Ultrasonographic Parameters in Assessment of IUGR in normal & high risk pregnancies"

Thesis

For

Doctor of Medicine

(Gynaecology & Obstetrics)



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JHANSI

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CERTIFICATE

Certified that the research work entitled ***"Comparative Study of Ultrasonographic Parameters in Assessment of IUGR in normal & high risk pregnancies"*** *was conducted by Dr. Monika Agarwal under my guidance and supervision. The investigations, techniques and statistics mentioned in the thesis were actually undertaken by candidate himself and the observations have been checked by me regularly.*

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Introduction

INTRODUCTION

The desire of every woman contemplating motherhood is that her pregnancy culminate in a healthy offspring who will achieve the highest possible physical and mental potential. Towards achieving this goal it remains the obstetrician's responsibility to reduce the well recognized implication and consequences of intrauterine growth retardation by early diagnosis and management.

The growth retarded fetus represents a failure to achieve recognized normal growth parameters.

It has been estimated that approximately 20%of all fetal deaths can be attributed to complication related to IUGR. This is further reflected in the recognition that from 30 to 40 per cent of all low birth weight infants (i.e. less than 2500 gm.)are growth retarded rather than just premature. The impact of this problem is reflected in the marked increase in perinatal mortality and morbidity seen in the growth retarded fetus.

Follow up studies have established that by the age of six years there is on an average a diminished intelligence quotient and smaller stature among children born with IUGR. Significantly higher number of children with speech defects, CNS abnormalities and poor school performance even with an IQ of over 100 were found with a history of IUGR.

There is a deceptive simplicity about the diagnosis of fetal growth retardation and there is no reliable definition of IUGR available before birth admittedly it can only be made in retrospect, when in utero becomes ex utero, and you can weigh the baby. The most commonly accepted definition being babies weighing less than the 10^{th} percentile for their gestational age at birth.

Antenatal diagnosis of a growth retarded fetus is difficult and when misdiagnosed, can lead to inappropriate medical intervention. For this reason obstetricians are preoccupied with finding methods that will facilitate early and reliable diagnosis of the growth retarded fetus.

Direct fetal visualization in utero by ultrasonics was introduced by Donald and Brown in 1960. since than the use of ultrasound to approximate the gestation age of the fetus and assess its well being in utero has become wide spread. Fetal biparietal diameter was the first parameter to be measured for this diagnosis and is probably still the one most commonly used.

Although measurement of biparietal diameter before the III trimester enable an accurate assessment of foetal maturity. It is not reliable for detecting fetal growth retardation especially the late flattening type.

Subsequently, continuous attempts were made to discover a more accurate parameter and various ultrasound measured indices were used

either singly or in formulations. These included abdominal circumference, head circumference, thoracic circumference crown rump length and femur length, cross-sectional areas of head and abdomen, quantitative assessment of liquor and total intrauterine volume and echogenecity of placental tissue.

The abdominal girth has been shown to be affected early in the IUGR process. The rationale for measurement of fetal abdominal circumference/diameter transactional area in the prediction of IUGR is based on the observation of gruenwenaly that mass and fetal intra abdominal organs principally the liver are severely affected in IUGR, this was thought to be due to depletion of glycogen in the liver. Keeping this in mind we have tried in the present study to evaluate whether estimation of Biparietal diameter, fetal femur length and abdominal circumference, FL/AL, FC/AC, would assist in the early diagnosis of IUGR.

Review of Literature

REVIEW OF LITERATURE

HISTORICAL ASPECTS :

Fetal growth retardation ranks third after prematurity and malformation as a cause of prenatal deaths. Antenatal fetal monitoring has emerged as the most important means of reduction in the number of still births and improvement in the quality of survival of infants who are born alive. Clinical finding combined with biochemical and ultrasonographic testing will identify as many as 70% of growth retarded fetuses. It should be the obstetrician's aim to identify all growth retarded fetuses at risk of death from hypoxia.

With present day methods of antenatal diagnosis and treatment and timing of delivery the physical and intellectual prognosis of growth retarded infants is most satisfactory with ideal set ups follow up studies have shown that only about 2% of the infants are severely handicapped.

In 1947, **Mac Burney** first introduced the concept of IUGR. **Clifford** in 1954, actually claimed that clinically significant intrauterine malnourishment can occur in utero associated with intrauterine asphyxia and soft tissue wasting and the attributed these changes to the decreasing placental function with advancing maturity. Karn and Penrose (1951) showed that the weight at which the mortality curve reaches its minimum

is several hundred grams heavier than the mean birth weight; a findings which was true for all human population later investigated (Wilcox and Russill, 1983).

Subsequently many workers entered into this field and much research has been done into the aetiolgy, pathology, diagnosis and management of this condition, its immediate and long term effects on the fetus and neonate.

Much confusion has occurred for describing IUGR, with a number of synonyms----------' Small for Gestational age (SGA), small for date, dysmature' low birth weight, placental insufficiencies, all being basically used to refer to the growth retardation.

The most widely accepted definition is that given by **Lubchenko** 1963, Battaglia, 1966, Bard, 1970; Fedrich and Adelstein, 1978---------' A foetus whose birth weight is below the tenth percentile for that period of gestation. The various birth weight tables used by different workers are Queehan (1976) Lubchenko et al, Arias (1977) Lubchenko et al, Kurjak (1977) Thompson et al, wladimiroff (1978) – Kloosterman, Deter (1980) – Brenner et al.

The birth weight tables by different authors for different populations vary.

EXAMPLES OF DIFFERENCES IN THE WELGHT TABLES USED TO IDENTIFY IUGR INFANTS.

Gestational age (wks.)	10^{th} Percentile				
	Thompson (gm)	Kloosterman (gm)	Lubchenko (gm)	Persson (gm)	Bronner (gm)
36	2330	2100	2050	2100	2190
38	2650	2650	2430	2500	2510
40	2884	2800	2630	2800	2750
42	3000	2720	3000	2830	3200

HISTORICAL ASPECT-ULTRASOUND DIAGNOSIS OF IUGR

Criteria used in the prenatal detection of IUGR in different investigations are:

Campbell (1974) BPD growth rate less than 5^{th} percentle

whetham (1976) BPD growth rate below- 2SD

Queenan (1976) BPD below- 2 SD any time

Crane (1977) BPD below- 2SD with normal growth rate

Arrias (1977) BPD growth rate below mean for gestaional age.

Campbell (1977) HC\AC above 95^{th} percentile within 7 days of delivery.

Sabaggha (1978) BPD growth rate between 26 weeks and 30 to 33 week below 25^{th} percentile.

Perrson (1978) Single BPD below 5^{th} percentile

Crane (1979)	Single BPD below –2SD serial BPD's below-2 SD during 3rd trimister. HC/AC above 95th percentile using.
(1979)	Normal values published by Campbell and Thomson.
Wladuimiroff (1979)	(BPD)2/AA above 95th percentile
Sittman (1979)	Single BPD,TA,CRL and CRL x TA below 10th percentile
Kuejak (1980)	Single BPD, BPD growth rate or AC or HC/AC below 10th percentile (parameters used or in combinations).
Dater (1980)	One or more HC/AC above 95th percentile using the normal values published by Campbell and thomson.

TYPE OF GROWTH RETARDATION

The classical picture of the growth retarded infant increased body length in relation to weight, relatively large head with wide skull sutures muscle wasting prominent ribs, an alert look and a dry wrinkled skin is readily recognised. Reduction in length and in brain weight is much less then the fall in body weight whereas weight of liver and spleen are relatively more reduced than body weight. In the past with unreliable data on gestational age, such disproportion, mainly expressed in terms of birth

weight compared with length and/or head circumference, were important criteria to distinguish preterm infants from growth retarded infants (Gruehwald, 1963).

In general these clinical types of IUGR can be subdivided into a 'soft tissue type' in which there is reduced soft tissue mass, mainly adipose tissue and muscle wasting) a skeletal type (In which length and head circumference are more affected), and a combined type with shows features of both the skeletal and soft tissue type. Various term have been used by investigators to indicate differences between the first two type. One thus encounters subdivision of sub acute versus chronic, symmetric versus asymmetrical, disproportional versus proportional, waste versus symmetrically small, soft tissue wasting versus underweight for gestational age, low ponderal lindex versus short for dates, and so on.

Symmetric & Asymmetric IUGR

Symmetric growth restriction emplied a fetus whose entire body is proportionally small. Asymmetric growth restriction implied a fetus who is under nourished & is directing most of its energy to maintaining growth of vitals organs such as brain & heart at the expense of liver muscle & fat this is due to placental insufficiency.

Asymmetric IUGR fetus has a normal head dimension but a small abdominal circumference (d/t decrease size). Scrawny limbs (b/o

decrease ms mass) & thinned skin (b/o decrease fat). Arrested head growth is of great concern to the developmental potential of fetus.

Distinction between disproportionally and proportionally grown or growth retarded infants is usually made on the basis of the ponderal index, a measure introduced some 60 years ago by Roghrer (1921) for comparing nutritional status of infants. This index the product of (birth weight in g) x 100/(length in cm)^3 – shows how heavy the infant is for his length and increases with accumulation of muscle mass and adipose tissue.

Ultrasonic assessment of fetal growth has revealed two principal types of growth retardation (Campbell, 1974). The first, called late flattening can be detected by serial measurements of Biparietal diameter, the BPD is within the normal range until after 30 weeks of gestation when its rate of growth slows or stops. Generally retardation of growth, of trunk if affected earlier and more severely. Comparisons of head and trunk growth have revealed a disproportionate decrease in the latter in 84.2% and 100% of such cases in studies of 19 and 7 fetuses respectively (Campbell, S. Thums A. 1977) Thus disproportion is a common feature and therefore also the term asymmetric growth retardation. Basically this type of IUGR is due to factors which compromise nutrition in an otherwise potentially healthy infant. There is a brain affect and there is preferential supply of fetal circulation to head and brain over the trunk.

Campball has shown that approximately 70% of SGA infants show late flattening BPD growth pattern in utero. However, Sabbagha found that 67% of SGA babies have abnormally slow BPD growth. A second type of growth retardation is called low profile. This growth pattern is characterized by a BPD that grows consistently slower than normal at least after 2 weeks. The fetus exhibits growth retardation which begins in 2nd trimester and affects all parts of the body more or less uniformly. Campbell considered it a manifestation of reduced growth potential and has also referred to it as hypoplastic IUGR, as the total number of cells are reduced, comparision of head and trunk growth have revealed a disproportionate decrease in trunk growth in 40% of the cases in a study (Campbell, 1977) Campbell has shown that about 30% of SGA infants show a low profile pattern. The low profile child has a relatively trouble free delivery, but later it found to be of subnormal IQ and stature (Fancourt et al, 1976). Affected fetuses are at much greater risk for congenital malformations than the general population (Ramzin et al (1973) according to Hansman. (1976) a significant number of these fetuses suffered intrauterine infections.

Aetiology :

Fetal growth can de defined as time – dependent increases in specific geometrical characteristics of the fetus and it depends on a complex interrelay of fetal, maternal and placental factors. Malfunction

of any of these factors lead to growth retardation. Thus, IUGR is multi factorial in origin and it is important to note that in over half the cases no obvious cause can be implicated potentially.

Potential causes of IUGR are dealt with below.

Although chromosomal abnormalities are estimated to occur in about 6% of conceptions (weight, 1976) and in 5% of recognized conspectuses (Hood 1981).

The presence of multiple Congenital malformations often leads to a clinical diagnosis of IUGR. Swab et al (1978) found that at 40 weeks of gestation the mean anencephalic birth weight was about 1000g. less than mean normal birth weight minus the weight of the brain. Of the congenital deformities those which affect the central nervous system and/or skeletal system have the most marked effect on fetal growth. IUGR is also common in fetuses with gastrointestinal abnormalities such as duodenal atresia (Girvans and Stephen S 1974). Omphalocoele (Columbani and Cunnigham, 1977). Potter's syndrome and renal agenesis too are associated with IUGR.

IUGR may be caused by infections of viral and bacterial origin. Upto 60% of infants with congenital rubella may be below the10th percentile of weight for gestation (Cooper et al, 1965). The rubella virus show a prediction for infecting vascular endothelium and may cause

placental villous atropy by introducing in the endothelium of villous capillaries (Driscoll, 1969).

C.M.V. is currently a common cause of congenital viral infection with an incidence ranging from 0.2 to 2.2% in different population (Stanzo et, al, 1983). Growth retardation occurs in about 40% of infants who present with clinical manifestations at birth (Stanzo et al, 1983). Varicella Zoster infection especially early in pregnancy can cause IUGR (Waterson and Lynel, 1947). Growth retardation is common in malarious mothers. In an endemic Malarious area McGregor, Wilson, ad Billsicz (1983) found that 20% of placenta were infected and in these cases birth weight was reduced by about 170g.

According to Brent and Jensh (1967) high dosage ionizing radiation during pregnancy may result in severe growth retardation.

Several drugs have been reputed to cause impaired fetal growth (Jhons and Chernoff, 1978). Howard and Hill 1979, Redmond 1979). Certain drugs appear to affect some but not all parameters of growth e.g. Hulesmaa et al (1981) found smaller head circumference without much changes in others parameters with use of the antiepileptic carbamezepine or with a combination of phenobarbitone and phenytoin, Chronic administration of corticosteroid are possible causes of growth retardation (Scott, 1977). More then 50 publications based or over ½ a million births reported that woman who smoked during pregnancy had babies of lower

birth weight than woman who did not. The size of differences (above 175 to 200g. or a depression of approximate 5%) was remarkably consistent in all investigations (Peters et al, 1983).

Effect of alcohol abuse on fetal growth may be mediated in a number of ways, direct effect of alcohol or its metabolite acetaldehyde are probably the most important. These include malabsorption of nutrients across the intestinal musoca, alleged maternal hepatic function, effects on amino acid transport across the placenta and effects of fetal metabolism and endocrine function (Rosett et al, 1983) Reduced fetal growth is most marked in the fetal alcohol syndrome which is characterized by :

(a) Prenatal growth retardation.

(b) Congenital malformation.

(c) Facial dysmorphology

(d) Disturbances of mental development. In these cases fetal weight is reduced by as much as 1200g. at term compared with controls and 5cm. length (Brerich 1978).

(e) Narcotics alone can impair growth (Reneteria and Lotongknum, 1977). Amongst infants exposed to herein in utero as many as 50% are growth retarded.

Placental Influences :

In the absence of gross pathology of the maternal fetal unit placental size shows a close correlation to fetal size. A large placenta is required to produce a large baby but the reverse is not necessarily true. Nevertheless, most growth retarded fetuses, have a fetal/placental weight ratio which is higher than that of normally grown fetuses. Thomson, Billewiez and Hitter (1968) showed that the fetal placental weight ratio increased from approximately 4.5 in the higher placental weight groups to about 7.3 in the lowest i.e. a growth retarded fetus shows some compensatory growth and tends to outgrow its small placental alterations (for e.g. calcification or so called infants that have been held responsible for otherwise unexplained fetal growth retardation, few have stood up to close scrutiny (Fox, 1981) placental abnormalities truly associated with low weight for gestation are haemangioma and extrachorial placenta (Fox, 1981).

Maternal Vascular Disease :

There appears to be general agreement that vascular pathology whether it is due to renal disease, essential hypertension, PIH, diabetes or collagen vascular disease, is the single most common denominator in the causation of IUGR frequency and severity of growth retardation is highest in pregnancy induced hypertension on superimposed in preexistent hypertensive disorders, lastly in PIH there is an undeniable

relationship with gestational age and the onset of disease. More and fedman (1983) formed that82% of infants of mothers in whom they diagnosed pre-eclampsia before34 weeks of gestation had birth weight below the 10thpercentile of weight for gestation.

Anaemia and low haemoglobin levels, vary with poor socioeconomic status, poor general nutrition and other factors known to be associated with poor birth weight (Butler and Alberman, 1964) Harison and Ibeziako (1973) demonstrated clearly that severe chronic anaemia (defined as hemotocrit of less than 30%, was associated with a reduction in birth weight about 100g. per 2% packed cell volume.

Perinatal mortality and morbidity and long term sequelae associated with IUGR :

20% of all fetal deaths can be attributed the impact of this problem is reflected in a marked increase in perinatal mortality and mordidity associated with IURG (Batteaglia, 1970 (Dobson et al 1981), William, et al 1982) it is associated with an eight fold increase in fetal moratlity 9Butler at Behern, 1963), a seven fold increase in mortality at birth due to anoxia, asphyxia and decreased PH and a significant increase in the incidence of neonatal problems such as polycythaemia, hypothermia, hypocalcaemia.

Diagnosis:

The diagnosis of IUGR is difficult and must be done along the following lines. Step one is to pick the population at risk – these will account for 2/3rd of the cases of IUGR step two is making a confirmatory diagnosis of IUGR then the following questions have to be answered.

1. What is aetiology of growth retardation ?
2. Can progression be modified. If so, how ?
3. What reliable parameters are available to monitor fetal well being.
4. Is delivery preferable, and if so when and how ?

A maternal obstetrical history accompanied by a physical examination will identify many of the pregnancy at risk of growth retardation. A maternal history of a previous small for gestational age infant puts the current pregnancy at 20-30% risk of again manifesting growth retardation. (Tejani, 1982). Maternal condition associated with IUGR are

Generic predisposition:

Previous IUGR infant

Family history

Cardiovascular

Chronic hypertension

Pre-eclampsia

Congenital heat disease

Infection

Rubella

CMV

Malaria etc.

Social

Cigarettee smoking

Drug abuse

Metabolic

Malnutrition

Chronic renal disease

Phenylketonuria

Others

Anaemia

Placentapraevia

Previous congenital malformations H/O still birth

Many scoring system have been proposed over the last few years to identify, more accurately the pregnancy at risk of development of IUGR (Galbraith et al, 1979, Gaziano et al, 1981. of these the eight factor scoring system proposed by wennergren and Karlsson, 1982) currently appears to offer the best result and least complexity. The system result in 100% sensitivity and 95.5% specificity. The following table gives this scoring system.

Variable	Weighted Value
H/O proved IUGR, still birth or neonatal death	1
B.. 140/90 or more after 34 weeks	1
History of renal disease or urinary tract infection in this pregnancy.	1 2
Smoking	1
Bleeding or preterm labour	1
Inadequate weight gain	1
Decrease (or non increase) in fundal height (Score = 4 + at risk of IUGR)	3

Methods of Diagnosis of IUGR

1. Clinical : Abdominal palpation, maternal weight loss, oliogohydramnios. Symphysis fundus height measurement fetal movement counts Kick charts.
2. Ultrasound Assessments : Single or battery of parameters single or serial measurement.
3. Cardiotocography
4. Tests of fetal conditions ± placental function.
5. Urinary or Plasma oestroil assay
6. Plasma placental lactogen

   Urinary pregnanediol or plasma progesterone, plasma pregnancy specific beta-1, glycoprotein. Serum cystyl aminopeptidatase maternal haemoconcentration in pre-eclampsia amnioscopy, Aminiocentesis, Vaginal cytology.

The Role of Ultrasound in the Evaluation of IUGR

Since the introduction of pulsed echo ultrasound into obstetric diagnosis in 1958 (Donald, Mac Vicar and brown, 1958). Ultrasonic diagnosis is concerned with the diagnosis of pregnancy, the viability and normality of the fetus, and in particular the accurate establishment of gestational age. In the latter half of pregnancy the major use of ultrasound is the fetal growth which is the outcome of complex interactions between the fetal genotype and numerous constraining and growth accelerating factors within the fetomaternal environment.

Dating the pregnancy – A necessary pre-requisite :

The correct interpretation of any ultrasonic parameter used for the diagnosis of IUGR requires knowledge of gestational period at the time of examination. Menstural history unreliable in the quarter to one third pregnant woman (Campbell, 1974), Grennert person and Gennser, 1978) and clinical examination is of increasingly limited help as a means of assessing gestational length as pregnancy advances (Beazley and Underhill 1970, Campbell, 1976). Ultrasonic CRL measurements of the embryo have an accuracy of ± 6 days. Upto 11-12 weeks gestation which improves to ± 3.4 days when these measurements are average (Robinson and Fleming, 1975, Pederson, 1982). In malmo the following formula has been developed for between 12-24 weeks-BPD x 1.2 + FL x 1.0 + 29.0 =

Gestational age in days, addition of femur length considerably adds the accuracy.

Measurements and functional tests of use / potential use in the diagnosis of IUGR.

One and two dimensional growth :

Skeletal	BPD, head circumference, Long bone lengths.
Soft tissues	Trunk diameters, area, circumference Thigh thickness, Subcutaenous fat thickness
Combination	Head / Trunk ratios

Three dimensional growth :

Weight	Fetal weight estimation, fetal volume
	Total intrauterine volume, intra-amniotic volume.

Functional (dynamic test)

Fetal breathing movements

Fetal umbilical vein/aortic blood flow

Fetal urinary bladder volume

Uterine blood flow

Placental Grading

1. **Bi Parietal Diameter :**

   Since the observation by Willocks et al. (1904) that dysmature infants have on average a smaller BPD than normal infants. The BPD has remained the basic fetal measurement in IUGR in spite of

its limitation which were pointed out in 1965 by Thompson et al. The BPD is often measurable as early as 11 weeks after the last menstrual period and by the13th week is visible and measurable with ease. From the 13th until the 30th week, the BPD represents a reasonably accurate method of detecting the fetal age. This accuracy is generally of ± 6 days. In the last trimester the accuracy decreases significantly the standard deviation maybe of ± weeks to ± 3 weeks.

The limitation with the use of BPD for detection of IUGR are that fetal head size is spared until the 3rd trimester of pregnancy and does not fall out side the normal range until very near term. Thus its use alone would result in a low sensitivity and a high number of false negative results. Secondly the variation if fetal head shape due to moulding and particularly, dolichocephaly which is observed in cases of ruptured membranes, twins breech – will result in abnormally low values and a high number of false positive cases diagnosed as IUGR.

Campbell (1971) was the first investigator to link foetal BPD to gestational age and also standardized method for recording BPD since many worker have developed normograms for assessing fetal growth from BPD measurements.

In the series of Campbell and kurjak (1972) 16% of fetuses with retarded ultrasonic growth pattern had a normal birth weight and 25%of the fetuses with normal cephalometric growth were small for gestational age.

Stocker et al (1974) showed that BPD measurement alone used to predict. Birth weight had too wide a range of predicted weights to be of clinical use, 1 SD ranging from 320 to 480 g.

Aanto and Korss (1974) also showed in their study that the growth curve flattened especially during the last month of pregnancy, In their series the weekly growth increment towards the end of pregnancy was 1 mm.

Queenan et al (1976 found BPD growth rate of 0.26 cm/week (18-38 weeks) in 468 normal pregnant females. He than studied 100 high risk patients and found two patterns of IUGR – those with BPD less than 2SD below mean and those with decreased growth rate of BPD or a combination of the two patterns.

Crame et al (1977) determined mean rate of growth of BPD at different gestational age.

The mean rates of growth given by them were :

3.1 mm/week between 19 to 30 weeks.

2.0 mm/week between 30 to 36 weeks

1.3 mm/week after 36 weeks.

Fernando Arias (1977) using the above, mentioned criteria to detect IUGR found that only 43 of the fetuses suspected of IGUR by ultrasonic cephalometry were found to be small for gestational age. He too found-two patterns of abnormal BPD growth. The most common, finding in 17 patients corresponded to 'low growth profile' type of IUGR and was characterized by continuous growth of the fetal head but at a rate below normal and with measurements falling consistently below the third percentile of normal growth. The second type observed in 11 patients, corresponded to the late flattening type of IUGR and minimal growth (<1mm / wk) of fetal biparietal diameter in the last trimester pregnancy.

Sabaggha (1978) used the GASA method (Growth adjusted sonographic age) to detect IUGR in 463 high risk pregnancies. He found 4 categories.

1. 75^{th} percentile – 3.5 had IUGR (asymmetrical)
2. 25^{th} – 75thpercentile – 3.5 had IUGR (asymmetrical)
3. 25^{th} percentile – 52.1% had IUGR (symmetrical)
4. Decreasing BPD – 20% IUGR (symmetrical)

Regarding the diagnosis of IUGR by serial BPD Campbell (1971), whethan (1976), reported an accuracy of 70-73%.

M. Sood et al (1976), reported accuracy of 75.4% while Sood et al (1985) reported an accuracy of 43-100%.

Lee and Chard (1983) measured fetal BPD by ultrasound at 18-21 weeks gestation in 1023 women and tried to assess its predictive value for diagnosis of IUGR. The sensitivity was 24.2%, predictive value was 18.2% and the specificity was 92.5% fetal head measurement.

Fetal Femur Length :

The shaft of the femur is the easiest fetal long bone to visualize and measure. However, the accuracy of estimating dates from femur length is controversial.

Jenaty and associates (1984-1985) conducted a large study involving femur length and showed that the accuracy of this parameter is within -+ 2.8 weeks (2SD) regardless of pregnancy used.

Further ward and associates (1985) showed that a straight line measurement of the slightly bowed femur bone (usually noted after 18 weeks of gestation) does not alter femur length in at least 69% of period comparisions. They felt that a straight line measurement is appropriate particularly because the resolution of most machines in any case is approximately 2mm and (b) the inter – observer variability is large namely 4.4mm.

Abdominal Circumference :

Nelson et al (1965) realized that measurements (1980) performed a 2 stage ultrasound examination schedule as a screening procedure for small for date fetuses on 474 single term pregnancies. In the first stage

examination CRL and BPD were measured for an accurate assessment of gestational age. In the second stage at 34-36 weeks the abdominal area and abdominal circumference were measured and an accuracy of 61% and 83.7% respectively was reported.

Steven L, wars of et al (1986) designated a prospective screening programme of a large obstetric population. 3616 pregnancies were analysed. All pregnancies were dated before the 24^{th} week by ultrasonic measurements. The study compared the effectiveness of three ultrasonic parameters. Biparietal diameter (BPD), head circumference and abdominal circumference. They concluded that abdominal circumference measurements were more predictive of IUGR than either head circumference or BPD measurements or the combination of these parameters. In view of the sensitivity of the test and the prevalence of the disorder, it is concluded that 34 ± 1 week of gestation is the optimal time to screen patients ultrasonically for IUGR.

Additional Crietria for diagnosis IUGR

Additional Sonographic Criteria for diagnosing IUGR have included elevated HC/AC ratio, elevated FL/AC ratio, presence of oligohydrammios without ruptured membrane, presence of advanced placental grade and other. Each of these sonographic parameters of featuses has been found to have a statistically significantly different mean value, or frequency of occurrence, in growth-restricted compared with normal fetuses. For a criterion to be clinically useful in a particular population of particular, to be useful for diagnosing IUGR, a criterion must have a high sensitivity and a high positive predictive value. That is, it must detect a substantial fraction of growth-restricted fetuses, and the likelihood of IUGR after a positive test result must be high(relatively few false-positive results). In analogous fashion, a criterion must have high specificity and negative predictive value to be useful for excluding IUGR.

The performance characteristics-sensitivity, specificity, predictive values-of sonographic (non-Doppler) criteria for IUGR are presented in Table 8-7 in order of increasing positive predictive value. Sensitivities and specificities were obtained by pooling data from the published literature, and predictive values were computed with Bayes' theorem 54 assuming a prevalence rate of 10%. The presence of a grade 3 placenta and an elevated FL/AC ratio have the lowest positive predictive values; the likelihood of IUGR is no more than 20% when either of these criteria

is positive. Seven of the nine criteria, including a low estimated fetal weight, have positive predictive values below 50%,so that a fetus meetingon of these criteria is more likely to be normal than growth restricted. An elevated HC/AC ratio had the highest positive predictive value, 62% but even on the basis of this criterion IUGR cannot be diagnosed with confidence because 38% (100%-62%) of fetuses with an elevated HC/AC ratio will not be growth restricted.

In contrast to the poor positive predictive values, all parameters had negative predictive values of at least 92% (see Table 8-7). This is a reflection of the low prevalence of IUGR, not of the excellence of the criteria for excluding IUGR. Ninety percent of fetuses are not growth restricted, so any reasonable test will have a negative predictive value of at least 90%. Overall, no single non-Doppler sonographic parameter permits the confident diagnosis of IUGR.

DIAGNOSIS OF IUGR USING MULTIPLE PARAMETERS

Because no single criterion is reliable for diagnosing IUGR, more accurate diagnosis might be achieved by using multiple parameters (Table 8-9). In view of interrelationships between the various proposed criteria-a small AC and otherwise normal measurements, for example, will lead to an elevated FL/AC ratio, elevated HC/AC ratio, and low estimated fetal weight-a rule for diagnosing or excluding IUGR should be based on a subset, as opposed to the entire group of criteria. The optimal

subset and the rule for diagnosing IUGR using this subset can best be found by using logistic regression analysis.

With this technique, we found that IUGR can be diagnosed most accurately using a combination of three parameters: estimated weight percentile, amniotic fluid volume, and maternal blood pressure status (normotensives. hypertensive, using the commonly accepted definition of hypertension during pregnancy as a diastolic pressure of at least 90 mm Hg or a systolic pressure of at least 140mm Hg or a rise in the former of a least 15mm Hg or in the latter of at least 30mm Hg). Diagnostic accuracy is not improved by considering additional parameters such as the FL/AC and HC/AC ratios.

These parameters can be used for diagnosing IUGR in two ways: one quantitative and the other semi-quantitative. The quantitative method uses an IUGR score derived from the logistic regression analysis. Alternatively, a table based on that IUGR score can be used. To diagnose or to exclude IUGR in a particular fetus, the table provides "rule-in" and "rule-out" estimated fetal weights corresponding to gestational age , amniotic fluid volume, and maternal blood pressure status. If the estimated fetal weight is below the lower rule -in value, IUGR can be diagnosed with confidence; if it is above the rule-out value, IUGR can be excluded. An estimated weight be excluded. An estimated weight between these values is indeterminate for IUGR. When the gestational

age is known precisely, based on a prior sonogram before 20 weeks, the situation is better in that the indeterminate range can be eliminated; an estimated weight below the rule-in value is diagnostic of IUGR, and an estimated weight above this value excludes IUGR, both with greater than 85% confidence.

Pregnancies at Elevated Risk for IUGR

In some pregnant women, the clinical history or physical examination may indicate an elevated risk for IUGR. When this occurs, an active approach to the diagnosis of IUGR should be undertaken, including one or more sonograms at appropriate time in the pregnancy.

The factors associated with increased risk may predate the pregnancy. Woman with chronic hypertension, collagen vascular disease, or a history of IUGR fall into this category. In these patients, the scanning protocol should include a first trimester sonogram for precise gestational age assignment, followed by at least one additional sonogram in the early to middle third trimester to assess fetal growth. Additional sonograms may be indicated, depending on the nature and severity of risk factors. For example, a woman at high clinical risk for IUGR should have sonogram at regular intervals (e.g. every 2 to 4 weeks) in the third trimester.

In other woman, the indicators of increased risk arise during the pregnancy. Examples include lag in fundal height or development of

hypertension during the pregnancy. In these women, a sonogram should be performed as soon as the indicator of high risk is recognized. This sonogram will provide information about gestational age and the size of the fetus and will serve as a baseline to assess growth on future sonograms if the woman remains at elevated risk for IUGR.

Summary

IUGR has been defined differently by various authors. We advocate defining IUGR as a fetal weight below the 10^{th} percentile for gestational age. Causes of growth restriction include primary placental insufficiency, placental insufficiency resulting from maternal disorders, fetal chromosomal abnormalities, and fetal infections.

Growth-restricted fetuses have a four to eightfold increased risk of perinatal mortality, and of those who survive, 50% have significant short- or long-term morbidity.

Sonography is useful for diagnosing IUGR has been diagnosed. Many sonographic and Doppler criteria have been proposed for diagnosing IUGR, but none on its own permits a confident diagnosis of IUGR. A multiparameter approach using a combination of estimated fetal weight percentile, amniotic fluid volume, and presence or absence of maternal hypertension is the most accurate method for diagnosing or excluding growth restriction.

Once IUGR has been diagnosed, an attempt should be made to determine its cause, including an evaluation of the mother for a maternal cause and a careful sonographic evaluation of the fetus, searching for evidence of a chromosomal or infectious origin. When a chromosomal or infectious cause is suspected, sonographically guided amniocentesis or sampling of umbilical blood can be used for further evaluation.

Unless the growth restriction is due to a lethal cause such as trisomy 18, the fetus should be monitored closely by sonogrphy for the remainder of the pregnancy. In particular, the estimated weight percentile, amniotic fluid volume, biophysical profile score, and Doppler waveform indexes should be followed up serially. A worsening trend in one or more of these items should prompt consideration of early delivery.

Material & Methods

MATERIAL AND METHODS

The present study was undertaken in the department of Obstetrics and Gynaecology in collaboration with the Radiology Deptt. Of M.L.B. Medical College, Jhansi where the Ultrasound machine was available.

Antenatal patients belonging to 28-40 weeks gestational age were studied. The cases selected, were from those attending the antenatal clinic of this department and for those lying in wards. After history taking and examination the patients were scanned.

The study was carried out in two groups of cases –

Group I : Control group (Normal cases)

Group II : Study group (IUGR cases)

Group I :

This group consisted of normal patients of known maturity belonging to 28-40 weeks gestational age without anyobstetrical and medical problems. These patients were subjected to an ultrasonographic examination of the following parameters.

(i) Biparietal diameter

(ii) Fetal femur length

(iii) (Abdominal circumference

(iv) Head circumference / Abdominal circumdference (HC/AC).

(v) Femur length / Abdominal circumference (FL/AC).

Group II :

It was conducted of patients in whom there was a clinical suspicion of IUGR or having a present or past history that could adversely affect the fetal growth e.g. toxaemia, anaemia and other conditions.

Pre-requisites for selection of patients (Group I).

(i) History of regular menstrual cycles.

(ii) A known last menstrual period.

(iii) A close relationship (±1 week) between menstrual age and clinical evaluation.

(iv) No maternal diseases known to affect normal fetal growth (e.g. diabetes mellitus, hypertensive disorders etc).

(v) Absence of multiple gestation.

(vi) Amongst multigravidas – those who did not have history suggestive of previous IUGR or still birth.

(vii) Patients belonging to 28-40 weeks of gestation.

(viii) Average weight gain in third trimester of more than 250 gm/week.

Pre-requisites for Selection of Patients (For Group II)

I) Patients with a known last menstural period and history of regular menstrual periods.

II) Patients whose fundal height was clinically less than the gestational age and /or low weight gain i.e. less than 250gm / week in the third trimester.

III) Patients between 28-40 weeks of gestation with clinical suspicion of IUGR.

IV) High risk cases were selected who were more prone to produce growth retarded babies such as pre-eclampic patients, hypertensive patients, previous history of IUGR, still birth, IUD etc.

The cases of both groups selected were examined clinically in the antenatal clinic. They were subjected to detailed history, general examination and called for an ultrasound scan on a certain date. A similar procedure was adopted for indoor patients.

History of Cases :

After recording the name, age caste, addresses and other identifying details of the patient history regarding the following was elicited.

a) Presenting complaints.

b) Menstural history (including last mestural period and regularity of the cycles.

c) Obstetrical history with special reference to any history suggestive of IUGR or history of IUD or still birth.

d) Past history including history suggestive of maternal diseases like diabetes , pre-eclamptic toxemia, and other medical problems.

e) Family history

f) Relevant personal history as regards per capita income.

Clinical Examination :

This was carried out under the following headings :

(i) General examination : The following points were observed – general condition of the patients, pulse rate, blood pressure, pallor, edema, jaundice, weight and height.

(ii) Obstetrical examination : this included abdominal examination to assess fundal height, fetal heart sound, lie, amount of liquor, and attempts to rule out multiple gestation specifically.

(iii) Supportive investigation : Heamoglobin percentage and urine testing for albuminuria were done.

Ultrasound Scanning :

All examinations of the patients were performed using a real time. USG 3.5-5 Mhz The ultrasonic measurements were recorded regularly on separate proformas for each patient along with the information already mentioned above.

A. Procedure of Scanning :

(i) The patient was made to lie supine on the examination couch and the abdomen extending from the symphysis pubis Xiphisternum was exposed.

(ii) The procedure of scanning was explained to the patient in an attempt to allay her apprehension.

(iii) An oil based medium was applied liberally over the abdominal area of prospective scanning so that the ultrasonic beam would not penetrate air when the transducer was brought in to contact with the skin of the patient.

(iv) To start with a mid line, sagittal scan of the abdomen was first done to see the position of the fetus. Parasagittal scans were then performed to observe the different parts of the body of the fetus to rule out the possibility of multiple pregnancy Fetal cardiac activity was noted, position of the placenta in relation to the segment of the uterus was also noted placental maturity in an attempt was graded and the amount of liquor amnii was assessed.

Each scan was performed in as short time as possible, consistent with taking accurate measurements and to expose the fetus and mother to the ultrasonic waves for as short time as possible. The scan was performed each time by the same person.

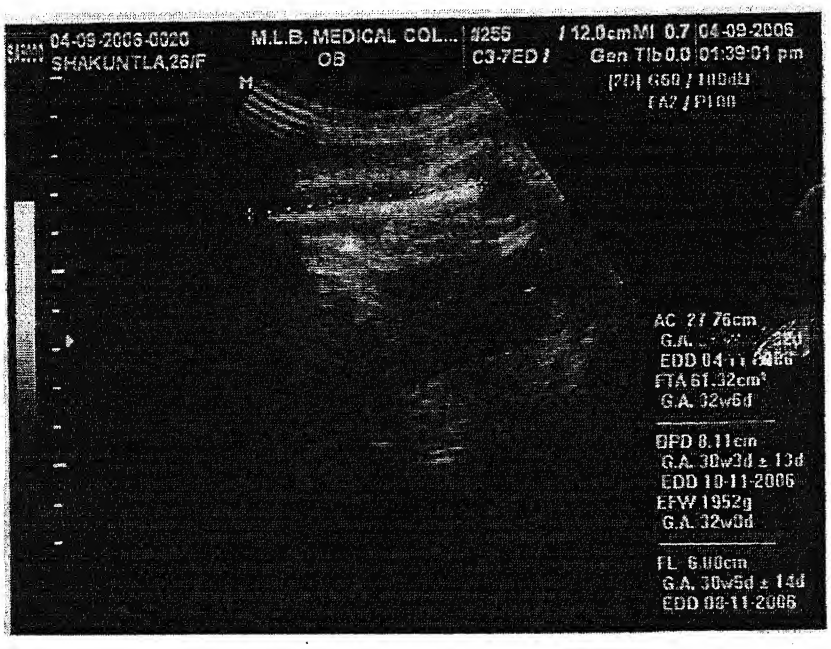
B. Measurement made for both the above mentioned groups the following measurements were made :

1. **Biparietal Diameter :** After visualizing the head in the sagittal section the transducer was rotated by 90° and inclined to meet the asynclitism. Gain settings were adjusted so that the width of skull tables near the transducer was 3-5 mm. The BPD was measured from outer to inner parietal skull tables obtained in the standard plane where the falx cerebi, cavum septum pellucidum, thalami and sylvian fissure could all be described.

2. **Fetal Femur Length :**

Long axis of the fetus was determined by visualizing the fetal neural tube. The transducer was shifted to the other side of the fetal body in the same plane. Direct visualization of the fetal femur was possible in

this plane when the lower limbs were flexed and in some cases the transducer was rotated obliquely or by 90° depending on the attitude of the limbs. Fetal femur length was measured from the greater trochanter to the lateral epicondyle. The measurements was made on anterior femur rather then posterior one. Thin bright reflection of cartilagenons epiphysis should not be included in measurement.



3. Abdominal circumference :

The fetal long axis was determined by visualising the fetal spine. At the level of umbilical vein the transducer was rotated by 90° to obtain a transverse section the fetal abdomen. Care was taken to obtain the transverse section of the abdomen by ascertaining that the entire umblical vein which runs obliquely was not visualized. To obtain the most appropriate plane the picture of the scan was made to include the entry

point of umbilical vein, a small section of the fetal stomach and inclusion of fetal kidney or suprarenal glands.

At this particular plane the anteroposterior diameter was measured from the abdominal wall facing the lowest part of umbilical part of left portal vein, to the processus spinosus of the thoracic spine. The transverse diameter was taken as the largest diameter parallel to a virtual tangent to the processes spinosus.

The patients studied were followed uptill the time of delivery and during labour and the following points were noted :

- Course of labour
- Signs of fetal distress
- Type of delivery and complications during delivery
- Examinations of newborn including assessment of Apgar score and weight at birth.

The data obtained was evaluated for :

(i) Construction of normal mean curves of the ultra sonic parameters in relation to gestational age.

(ii) Regression analysis of these parameters and gestational age.

(iii) Comparision of fetal femur length and biparietal diameter abdominal circumference HC/AC & FL/AC for the prediction of IUGR.

These were observed for both the groups (I and II) i.e. the normal cases and IUGR cases, the results of which were compared. By these subsequent observation and analysis, normograms could be established for further use for assessing the size of the foetus of unknown gestational age and estimate the maturity of the fetus.

Observations

OBSERVATIONS

The present study was conducted in department of Obstetrics & Gynaecology & department of Radiology of M.L.B. Medical College, Jhansi.

Total 134 women were studies & these were divided into two groups.

Group – I – this group consist of 104 antenatal patient with normal pregnancy known last menstrual period with regular menstrual history.

Group – II – This group consist of 30 patients who were at risk cases / or/ clinically suspected IUGR cases with known last menstrual period irregular menstrual history. In this group gestational age ranged from 28-40 weeks. They were scanned serially twice.

Patients of both groups subjected to a complete clinical examination and were studied ultrasonographically for following parameters of growth and maturity.

(1) Biparietal diameter.

(2) Fetal femur length

(3) Abdominal circumference

(4) Head circumference / Abdominal circumference.

(5) Femur length / Abdominal circumference.

Each parameters in relation to gestational age study and compared in both groups.

Table-1 – Group Wise Distribution of Cases.

Group	Number	Percentage
Group I (Control)	104	77.61
Group II (IUGR)	30	22.39
Total	134	100.00

77.61% of total cases belongs to Gr I & 22.39% of total cases belong to Gr II (IUGR).

Table – 2

Distribution of cases according to maternal weight gain / week during last trimester in group II.

Mat wt. gain gm/wk	Group II (IUGR)	
	Number	Percentage
100-150 gm/wk	0	0
150-200 gm/wk	20	66.67
200-250 gm/wk	8	26.67
>250gm/wk	2	6.66
Total	30	100

This table shows 66.67% of cases had a wt gain in range of 150-200gm/wk. Only two cases had a weight gain > 250gm/wk and both were cases of Pre-eclamptic toxemia.

Table – 3 : Represent distribution of cases according to gestational age for Gr I & Gr II gestational period ranged from28-40 weeks for Gr II each Patient subject to two scans and therefore these were 60 readings.

Gest Age Week	Gr I Control	Gr II (IUGR)
28 weeks	6	4
29 weeks	4	3
30 weeks	4	3
31 weeks	4	4
32 weeks	6	4
33 weeks	4	4
34 weeks	6	4
35 weeks	10	4
36 weeks	12	6
37 weeks	9	6
38 weeks	10	6
39 weeks	14	6
40 weeks	15	6
	104	60

Maximum case distributed around 35-40 weeks in both Gr I & Gr II.

Table – IV Distribution of cases acc. to risk factors in Gr II.

Risk Factor	No. of Cases	Percentage
Anemia & Malnourishment	9	30
Pre-eclampsia	7	23.33
BOH (Bad Obst. History)	2	6.66
Smoking	3	10.0
H/O Bleeding / Preterm labour	3	10.0
No obvious risk factor	8	20.00

BOH include previous abortion, IUGR, Still birth, IUD &Congenital anomally in6.66% of cases.

Table V – Distribution of cases according to mode of delivery in group I & group II.

Group	No. of Cases	FTND		Forceps		LSCS	
I	104	81	77.8%	13	12.5%	10	9.6%
II	30	16	53.3%	8	26.6%	6	20%

Gr II has a lesser percentage of vaginal deliveries 53.33% as compared to control group.

Rate of forceps application & caesrean section was more in Gr II as compared to control group.

BPD and Gestational Age :-

Table – VI Mean fetal BPD in relation to gest. Age in Gr I & Gr II.

Gest. Age	Gr I (Control)			Gr II (IUGR)		
	No.	Mean BPD mm	SD ±	No.	Mean BPD mm	SD ±
28	6	71.5	0.50	4	70	2.70
29	4	72.5	2.50	3	72	1.4
30	4	75.2	1.48	3	72.5	1.25
31	4	84.2	3.77	4	71.6	1.5
32	6	83.6	4.15	4	78.5	1.12
33	4	85.25	0.83	4	80.5	2.12
34	6	86.33	3.5	4	83.2	0.83
35	10	87	2.28	4	83.3	6.02
36	10	87	1.97	6	84.0	4.61
37	9	90	1.63	6	88.0	1.00
38	10	91.6	1.36	6	88.5	1.98
39	14	91.2	2.4	6	85.17	1.21
40	15	93	2.54	6	87.33	1.25

There was a progressive increase in BPD in Gr I with gestage. In Gr I it increased from 71.5mm at 28 wks to 93.07 mm at40 wks. BPD increases at farily rate upto 36 wks after which there in slight flattening.

Gr II – also shows increase in BPD from 70 mm at 28 wks to 87.33mm at 40 wks.

In all gestatational age BPD of Gr II is less than that of Gr I of same gest age., growth of BPD is less in such as compared to N fetus.

ABDOMINAL CIRCUMFERENCE

Table VIII- Mean abdominal circumference in relation to gest age in Gr I & Gr II.

Gest. Age	**Gr I (Control)**			**Gr II (IUGR)**		
Week	No.	Mean BPD mm	SD ±	No.	Mean BPD mm	SD
28	6	219.27	5.40	4	186.88	1.89
29	4	230.55	1.85	3	209.97	17.00
30	4	237.75	1.01	3	218.17	10.66
31	4	254.5	1.16	4	240.08	10.35
32	6	263.8	12.39	4	243.43	15.52
33	4	271.2	3.09	4	247.4	16.20
34	6	292	16.33	4	252.95	12.99
35	10	297	3.23	4	257.1	7.26
36	10	309	16.92	6	270.5	7.49
37	9	323	13.30	6	279.7	14.62
38	10	313	7.71	6	284.8	10.2
39	14	321	13.43	6	279.4	21.15
40	15	326	14.26	6	299.5	11.05

In both groups it increases progressively with age. In group 1 it increases from 219.27 at 28 weeks to 326mm at 40wks & in Gr 2 it increases from

186.88 mm at 28wks to 299.25mm at 40 wks for same gest age in Gr II these is significant less abdominal circumference in Gr II in comparision to Gr I.

Table IX :- FL/AC value in relation to gestational age..

Mean Fetal femur length / Abdominal circumference in relation to gestational age in Gr I & Gr II.

Gest. Age	Gr I (Control)			Gr II (IUGR)		
	No.	Mean FL/AC	SD±	No.	Mean FL/AC	SD±
28	6	0.232	.02	4	0.276	.03
29	4	0.230	.03	3	0.252	.035
30	4	0.231	.06	3	0.244	.041
31	4	0.228	.04	4	0.235	.043
32	6	0.226	.03	4	0.246	.052
33	4	0.229	.05	4	0.254	.06
34	6	0.226	.03	4	0.256	.07
35	10	0.217	.02	4	0.247	.08
36	10	0.215	.01	6	0.235	.05
37	9	0.207	.05	6	0.238	.06
38	10	0.216	.07	6	0.241	.05
39	14	0.220	.09	6	0.247	.04
40	15	0.222	.07	6	0.239	.05

It is obvious from above table that for same gestational age femur length / Abdominal circumference is more in Gr II as compared to Gr I. This

indicates abdominal circumference is more affected than femur length in IUGR fetus.

Table X :- (This table show Head Circumference / Abdominal circumference ratio according to gest age in & Gr I & Gr II)

Gest. Age	Gr I (Control)			Gr II (IUGR)		
	No.	Mean HC/AC	SD ±	No.	Mean HC/AC	SD ±
28	6	1.315	0.02	4	1.32	.04
29	4	1.16	0.01	3	1.24	0.05
30	4	1.157	0.04	3	1.23	.06
31	4	1.122	0.08	4	1.17	.07
32	6	1.107	0.1	4	1.194	.06
33	4	1.105	0.11	4	1.18	.08
34	6	1.04	0.09	4	1.167	.10
35	10	1.05	0.08	4	1.146	.10
36	10	1.03	0.08	6	1.122	.02
37	9	1	0.07	6	1.11	.07
38	10	.98	0.15	6	1.10	.10
39	14	.96	0.16	6	1.10	.3
40	15	.94	0.09	6	1.10	.10

For same gest age HC/AC ratio is more as compared to (n) fetus in all high risk pregnancy because AC is more affected then HC.

FEMUR LENGTH

Table XI : Mean Fetal Femur length in relation to gestational age in Gr I & Gr II

Gesta-tional age (wks)	Group I			Group II		
	Total No.	Mean FFL mm	SD ±	Nos.	Mean FFL mm	SD ±
28	6	51.75	1.48	4	51.75	1.09
29	4	54.00	1.00	3	43.67	0.94
30	4	55.00	1.58	3	53.33	1.7
31	4	58.25	1.09	4	56.5	1.12
32	6	59.83	1.34	4	58.0	0.71
33	4	62.25	0.83	4	62	1.58
34	6	65.0	1.91	4	62.5	1.58
35	10	64.8	1.4	4	63.5	1.8
36	11	66.7	1.42	6	63.50	2.36
37	9	67.2	1.69	6	66.87	8.72
38	18	67.8	1.33	6	67.67	1.7
39	14	71.07	1.67	6	69.17	2.67
40	15	72.06	1.58	6	71.67	2.05

In Both groups it increases progressively with age. In group I increases from 51.75 at 28 wks to 72.06 at 40 wks and in Group II it increases 51.75 mm at 28 wks to 71.67 at 40 wks but growth of Fetal femur length is less in Group II in comparison to Group I.

Comparision of Gestational Age of Gr I & Gr II :

Group	No.	Mean GA	T	P
I	104	35.28	10.725	.05
II	64	34.82	-	-

On comparing gest age of two groups as has been shown in table difference in gest age of both groups was statistically insignificant ($p>.05$) thus both groups are comparable.

Comparision of Mean BPD of both the groups.

Group	No.	Mean (mm)	SD	T	P
I	104	86.71mm	7.38	4.925	<.001
II	64	81.82mm	6.36		

Mean BPD value of Gr I & Gr II shows statistically significant difference.

Comparision of Mean FFL of both groups.

Group	No.	Mean FL	SD	T	P
I	104	64.88mm	7.03	1.412	P>.05
II	64	63.32mm	6.42		

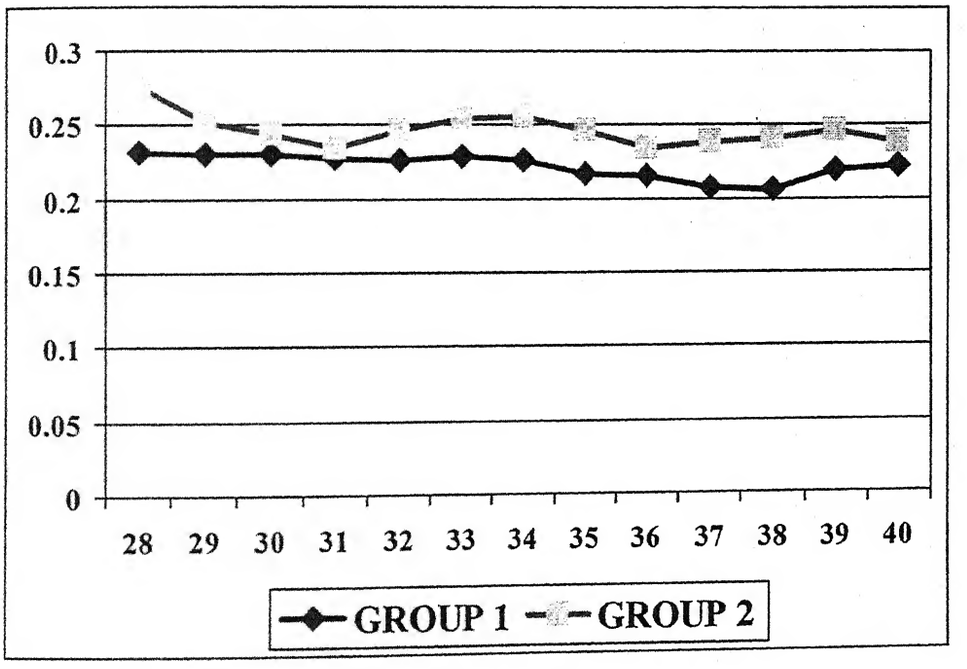
Difference in fetal femur length of Gr I & Gr II is statistically insignificant.

Comparision of Mean Abdominal Circumference in Gr I & Gr II.

Group	No.	Mean FL	SD ±	T	P
I	104	292.66	39.99	5.36	<.001
II	60	260.47	31.3		

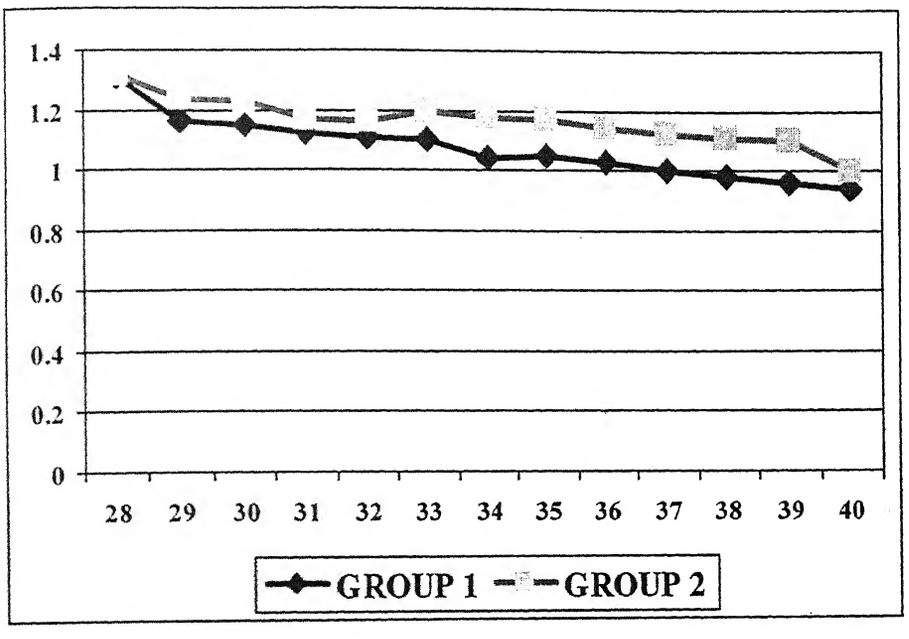
Difference in mean abdominal circumference of Gr I & Gr II is statistically significant.

Comparison of Mean FL/AC in Gr I & Gr II.



By this graph it is shown that for same gest age. FL/AC is more (>.235) in Gr II as compared to Gr I so it is significant difference.

Comparision of HL/AC of Gr I & Gr II



By this graph it is shown that for same gest age HC/AC is more than in Gr II in comparison to Gr I so it is significant difference.

Comparision of Birth Weight & Fetal outcome in Gr I & Gr II.

	Mean Wt. (Kg)	SD±	T	P
Group - I	2.89	0.23	15.929	<.001
Group - II	2.17	0.17		

Group I & Group II has significant difference.

Apgar at 1 min.

	Mean	SD±	T	P
Group - I	8.21	0.83	10.35	<.001
Group - II	0.47	0.86		

Group I & Group II has significant difference.

Discussion

DISCUSSION

The present study was conducted with the aim of evaluating certain ultrasonic parameters of growth and maturity in cases of normal pregnancy between 28-40 weeks and also in pregnancies with high risk or clinical suspicion of Intra uterine growth retardation. This study consisted of a total of 164 scans of which 60 were performed on the IUGR group. These 60 scans consisting of serial scanning of 30 IUGR pregnancies fare reasonably as compared to a cross sectional data of 104 scans on control cases. These parameters were evaluated so that timely interference and termination of pregnancy could be done to improve foetal well being, survival and reduce the incidence of perinatal mortality and mordidity associated with IUGR.

Early reports on the sonographic evaluation of the fetus were focused on BPD as a function of gestational age (Sabbage et al, 1978 and Kurtz et al 1980) later abdominal circumference and thoracic circumference, areas and long bone measurements were used for evaluating the fetus.

All the patients in group II had a fundal height at least 3 weeks less than that corresponding to the period of gestation, while 93.34% of patients had a weight gain less than 250gm/week. Two patients who had a

weight gain per week of more than 250mg/week suffered from pre-eclampsia and the weight gain could be due to oedema.

Patients in group II were evaluated for any risk factor predisposing to IUGR and it was observed that no risk factor could be found in 20.07% cases. Low et al (1971) reported that in 48% of patients of IUGR no etiology could be detected.

Galbraith et al (1978) reported that one third of IUGR cases from pregnancies that had no apparent risk factors.

In Ounsted's series (1963) 31.5% of patients were reported to have hypertension while Galbraith et al (1979) reported that 35% of patients with severe PET suffered from IUGR. In our study 23.33% of patients had PET.

Galbraith (1979) and Carrera (1980) noted a higher incidence of bad obstetric history in their patients. In the present study 3 patients (6.66%) had a bad obstetric history.

In this study there were no still births or intrauterine deaths. In group II there was one neonatal mortality, the baby dying of broncho pneumonia. The incidence of normal vaginal delivery was more in groupI i.e. 77.88% as compared to group II 53.33%. The incidence of low forceps delivery and lower segment caesarean section was greater in group II. (26.67% and 20%) respectively. The higher incidence of operative delivery in IUGR group (II) as compared to deliveries in group

I (control) could be explained by the higher incidence of acute and chronic foetal distress and due to various maternal factors led to IUGR in the first place.

The difference in mean birth weight and the Apgar at birth was found to be statistically significant between group I and II. They being significantly lower in group II.

ULTRASONIC PARAMETERS :

BPD –

In our study too the mean BPD values have shown a uniform increasing patterns with minor variation at 32 weeks and 39 weeks of gestation and a flattening in the growth curve in the latter part of gestation.

The difference in mean BPD of group I and II was found to be statistically ($t=4.295$, $p<.001$) significant. The BPD in group II also correleated very well with gestational age. The BPD of the foetal skull is an excellent means of estimating gestational age in the III trimester.

According to work done by Doublief and Benson in 1993 BPD at 28 weeks is 70mm & at 40 weeks 93mm. In my study BPD at 28 weeks is 71.5 mm & at 40 weeks is 93mm.

FETAL FEMUR LENGTH :

The fetal femur length was also found to be significantly correlated ($p<.001$) to gestational age in both group I and II. The mean FFL in group

I ranged from a minimum of 51.7mm at 28 weeks to 72.60mm at 40 weeks of gestation and showed a weekly rising pattern with a minor variation at 35 weeks of gestation. The maximum predicted FFL in our study at 40 weeks 73.00mm compared to predicted values at 40 weeks by workers in the west namely 87mm Jently et al, 1981. 80 mm Hadlock et al 1981, 76mm Hadlock et al 1982. The difference could again be explained on the basis of the difference in race genetic potential and socioeconomic status the group II had lesser mean values of FFL at most periods of gestation the difference was found to be statistically insignificant (t=1.412.p>.05)

It is found out that FFL is a reliable indicator of gestational age but it is not a useful parameter for prediction of fetal growth retardation.

ABDOMINAL CIRCUMFERENCE

Normal variability in abdominal circumference at various stage in pregnancy has been evaluated by several investigators the data of Dater et (1982) and Hadlock et al (1982) holding the maximum validity at present. The predicted values of our study compared favourably with those of their study. At 28 weeks our predicted value was 219 mm while it was 230mm & 239 mm in the study of Deter and Hadlock respectively.

HC/AC

HC/AC ratio is more in all Gest age in IUGR babies as compared to (N) fetus because Abdominal circumference is more affected than head

circumference because Vital organs like Brain, heart, blood supply is least affected this ratio compares most pressured organ in malnourish fetus; brain with most compromised liver. So it is of significance value in of IUGR. More HC/AC at 28 weeks in our study is 1.31in GR I compared with HC/AC at 28 weeks is 1.08±25 evaluated by (Halock) FP Deter, RL, Harrist RB 1983) & at 40 weeks in our study it is 0.94 in (N) fetus. It is compared with HC/AC at 40 wks is 0.98 evaluated by (Hadlockk, Deter, Harrist, 1983).

FL/AC :

FL/AC ratio is more in Gr II as compaed to Gr I in all gestational ages because abdominal circumference affected more than femur length as described previously. So FL/AC will increase in IUGR incomparision to (N) fetus.

Acc. to Hadlock Deter, harrits 1998 FL/AC at 28weeks is 0.23 ± 0.25SD & at 40 weeks 0.214

In our study FL/AC at 28 weeks is 0.232 & 40 weeks is 0.22 in Gr I patient.

It is proved that FL/AC (N) value 22±2 of upper limit of 23.5(90^{th} percentile) has specificity of 90% by fernaldo.

Summary & Conclusion

SUMMARY AND CONCLUSION

The present study was carried out in the Department of Obstetrics and Gynaecology and Radiology M.L.B. Medical College, Jhansi. A total of 134 cases were studied (between 28 and 40 weeks of gestation) belonging to two groups (normal and at risk group), and were examined ultrasonographically.

Ultrasound fetal measurement is the leading method of evaluation of normal fetal growth and fetal growth retardation. The search for a more accurate parameter for detecting growth retardation continues. This study was carried out to help in establishing standards for these parameters for our part of the country and to assess their efficacy for the early diagnosis of IUGR.

The following conclusions were drawn from the present study :-

1. The maximum number of patients in both group I and II were in the age group of 21-30 years i.e. the active reproductive age group.
2. No correlation was found between maternal age parity and height and growth retardation.
3. Mothers carrying IUGR fetuses had a statistically significant lower weight than mother in the control group.

4. The incidence of IUGR was greater in patients with a lower socio-economic status.

5. 93.64% cases in the IUGR group had a weight gain of less than 250gm/week in the last trimester.

6. All cases of IUGR had a fundal height at least 3 weeks less than the period of gestation.

7. Anemia & Malnourishment was the commonest risk factor in our series and was noted in 30.00% of cases. PET was the second commonest risk factor being noted in 23.33% of cases. No obvious risk factor could be detected in 20% of cases. BOH in 6.66% cases.

8. The bi-parietal diameter, fetal femur length and abdominal circumference, FL/AC & HC/AC were correlated significantly with gestational age in both the normal as well as IUGR group.

9. The BPD growth curve showed a linear pattern with a constant weekly increase in the growth rate of BPD but the curve showed a flattening towards the latter part of gestation.

10. A significant difference was found between the mean values of BPD, AC in group I and II. The difference in mean FFL group I and II was statistically insignificant.

11. FL/AC in gr II >.235 as compared to Gr I which is significant difference.

12. HC/AC in gr II is >1 in all gestational age but in Gr I. It is <1 after 34 weeks gestation which is significant difference.

Thus it is concluded that for prediction of IUGR, measurements of bi-parietal diameter, abdominal circumference, HC/AC & FL/AC ratio and are a fairly accurate assessment of the gestational age and retardation of growth in utero is possible.

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